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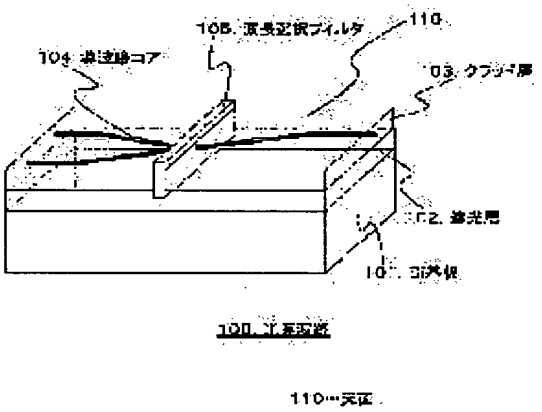
(54) OPTICAL WAVEGUIDE AND OPTICAL SIGNAL TRANSMISSION AND RECEPTION MODULE AS WELL AS METHOD FOR MANUFACTURING THE OPTICAL WAVEGUIDE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a technique related to optical waveguide and optical signal transmission and reception module, which shield stray lights of the signal light to a photodetector by disposing a light shielding layer between a silicon substrate and waveguide core, in the process for manufacturing the substrate of the optical waveguide as well as a method for manufacturing the optical waveguide.
SOLUTION: This optical waveguide 100 related to the form of this embodiment is approximately composed of an Si substrate (semiconductor substrate, silicon substrate) 101, a light-shielding layer 102, cladding layer (tungsten-silicon layer) 103, the waveguide core 104 and a wavelength selection filter 105.



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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention belongs to the technique about the optical waveguide manufacture approach at the optical waveguide of a quartz system and the optical transceiver module list especially using a silicon substrate about the optical waveguide for optical transceiver modules used by an optical access system etc.
[0002]
[Description of the Prior Art] Conventionally, in order that the optical module used for an optical access system may plan miniaturization and cost reduction, it is becoming in use applying [of the optical transceiver module which unified the transmitting function and the reception function using optical waveguide etc.] it. The demand to expansion of the information-transmission capacity backed up for the explosive spread of the Internet as this background is. In order to meet this demand, by the basic system, development utilization of a high density wavelength multiplex transmission system etc. is progressing quickly. In connection with this, the demand of information-transmission capacity expansion has spread even in the general user, and Guanghua of an access system has been promoted powerfully.
[0003] By the optical transceiver module, LD component for transmission and PD component for reception are integrated in one optical transceiver module, and in the optical transceiver module to which transmission and reception perform simultaneous operation, since a surroundings lump and this stray light component serve as a noise to signal light at PD component for reception in the light from LD component which is not combined with a waveguide core as the stray light, receiving sensibility degradation of an optical transceiver module arises.
[0004] The conventional optical transceiver module was taking the stray light measures of the wavelength isolation of a wavelength selection filter by enlarging. For example, such an optical transceiver module is indicated by work "1.3/1.55micromWDM light module for simultaneous transmission and reception using a PLC platform" (1998 Institute of Electronics, Information and Communication Engineers electronics society convention) besides Hashimoto.
[0005] Moreover, the approach of intercepting the stray light by which outgoing radiation was carried out from PD component is indicated by by preparing protection-from-light members, such as protection-from-light nature resin, in the front face of PD component as other techniques at JP,11-248978,A, or being prepared in the front face of the substrate which has the waveguide which spreads signal light inside.
[0006]
[Problem(s) to be Solved by the Invention] However, there was a trouble hung up over below in the conventional technique. Since it had structure which prepares a slit in optical waveguide and inserts a wavelength selection filter by the conventional optical transceiver module, the stray light via a silicon substrate was difficult to oppress. That is, although it could oppress when fully securing wavelength isolation, such as a wavelength selection filter, about a waveguide core and the stray light of a cladding layer, in the simultaneous-transmission-and-reception actuation by wavelength multiplexing, a part of

stray lights had the trouble of carrying out incidence to PD component via a silicon substrate.
[0007] This invention is made in view of this trouble, and the place made into the purpose is in the point of providing with the technique about the optical waveguide manufacture approach the optical waveguide and the optical transceiver module list which shade the stray light of the signal light to a photo detector, by preparing a protection-from-light layer between a silicon substrate and a waveguide core in the substrate production process of optical waveguide.
[0008]
[Means for Solving the Problem] The summary of this invention according to claim 1 is optical waveguide which leads the signal light from the light emitting device in an optical access system to a photo detector. The semi-conductor substrate as a platform substrate, Having the cladding layer which has the waveguide core of signal light, and the protection-from-light layer arranged between this cladding layer and said semi-conductor substrate, this protection-from-light layer consists in the optical waveguide characterized by shading the stray light of said signal light which carries out incidence to said photo detector from said light emitting device through said semi-conductor substrate. The summary of this invention according to claim 2 consists in the optical waveguide according to claim 1 characterized by forming a protection-from-light layer in the top panel of said cladding layer. The summary of this invention according to claim 3 consists in the optical waveguide according to claim 1 or 2 characterized by said protection-from-light layer being a tungsten-silicon layer. The summary of this invention according to claim 4 consists in the optical waveguide according to claim 1 to 3 characterized by said semi-conductor substrate being a silicon substrate. The summary of this invention according to claim 5 is an optical transceiver module used by the optical access system, it has optical waveguide according to claim 1 to 3, and the protection-from-light layer which this optical waveguide has consists in the optical transceiver module characterized by shading the stray light of the signal light which carries out incidence to a photo detector from a light emitting device through the semi-conductor substrate used as a platform substrate. The summary of this invention according to claim 6 is the manufacture approach of the optical waveguide which leads the signal light from the light emitting device in an optical access system to a photo detector, and consists in the optical waveguide manufacture approach characterized by leaving the mask used in order to etch the front face of the semi-conductor substrate used as an abbreviation tabular platform substrate into a predetermined configuration as a protection-from-light layer. The summary of this invention according to claim 7 consists in the optical waveguide manufacture approach according to claim 6 characterized by using tungsten-silicon for said protection-from-light layer. The summary of this invention according to claim 8 consists in the optical waveguide manufacture approach according to claim 6 or 7 characterized by using a silicon substrate for said semi-conductor substrate.
[0009]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing. As shown in drawing 1 , the outline configuration of the optical waveguide 100 concerning the gestalt of this operation is carried out with the Si substrate (a semi-conductor substrate, silicon substrate) 101, the protection-from-light layer 102, a cladding layer (tungsten-silicon layer) 103, the waveguide core 104, and the wavelength selection filter 105.
[0010] On the Si substrate 101 as a platform substrate, a W-Si (tungsten-silicon) layer is prepared as a protection-from-light layer 102. This protection-from-light layer 102 is prepared between the Si substrate 101 and the cladding layer 103 which has the waveguide core 104, intercepts the stray light which carries out incidence to PD (photo detector) component by Si substrate 101 course from LD component (light emitting device), and raises optical isolation. Moreover, this W-Si layer is used as a mask at the time of forming the V groove for waveguide core 104 mounting to optical waveguide 100, and the plinth for LD component mounting, and it can form easily a part predetermined also even in after V groove formation by leaving without performing etching etc.
[0011] In drawing 1 , the approach of securing the wavelength isolation of the wavelength selection filter 105 is adopted and illustrated about the conventional protection-from-light approach for the stray light of the waveguide core 104 or a cladding layer 103.

[0012] Drawing 2 is the block diagram of the optical transceiver module which used the optical waveguide of drawing 1 . The outline configuration of the optical transceiver module 200 is carried out with optical waveguide 100, the LD component (light emitting device) 202, the PD component (photo detector) 203, an optical fiber 204, and the wavelength selection filter 105.
[0013] Next, actuation of an optical transceiver module is explained using drawing 2 . It reflects with the wavelength selection filter 105, and outgoing radiation of the signal light from the LD component 202 is carried out from an optical fiber 204. On the other hand, the signal light from an optical fiber 204 penetrates a wavelength selection filter, and it carries out outgoing radiation to the PD component 203.
[0014] In the simultaneous-transmission-and-reception actuation by wavelength multiplexing, such as an ATM-PON method, if the stray light from the LD component 202 carries out incidence to the PD component 203, the signal light from an optical fiber 204 is normally unreceivable. On the other hand, in addition to the conventional approach of shading the stray light of the waveguide core 104 and a cladding layer 103 by securing the wavelength isolation of the wavelength selection filter 105, the protection-from-light layer 102 in the gestalt of this operation can oppress the stray light which carries out incidence to the PD component 203 by Si substrate 101 course.
[0015] Since the optical waveguide concerning the gestalt of operation is constituted like the above, the effectiveness hung up over below is done so. The stray light which carries out incidence to the PD component 203 by Si substrate 101 course can be oppressed by forming the protection-from-light layer 102, and the bad influence which it has on the PD component 203 can be controlled to the minimum.
[0016] In addition, although the configuration which formed the slit in optical waveguide 100 and built in the wavelength selection filter 105 explained with the gestalt of this operation, effectiveness with the same said of the configuration which added the WDM function to the interior of the substrate of optical waveguide 100 by Mach TSUENDA etc. is acquired. Moreover, effectiveness with the same said of the configuration which sticks the wavelength selection filter 105 on the end face of optical waveguide 100 is acquired.
[0017] Moreover, although the configuration using the W-Si layer as a protection-from-light layer 102 explained, protection-from-light nature members with other protection-from-light nature, such as a protection-from-light nature resin layer and a protection-from-light nature metal layer, can also be used.
[0018] Moreover, although the protection-from-light layer 102 is formed in the inferior surface of tongue of the waveguide core 104, it is also possible by forming the protection-from-light layer 102 in the top face 110 of the waveguide core 104, i.e., the top panel of a cladding layer 103, to control the stray light which leaks from the top face of the waveguide core 104.
[0019] In addition, in the gestalt of this operation, this invention is not limited to it, but when applying this invention, it is applicable to the technique about the optical waveguide manufacture approach at suitable optical waveguide and an optical transceiver module list.
[0020] Moreover, the number of the above-mentioned configuration members, a location, a configuration, etc. are not limited to the gestalt of the above-mentioned implementation, but when carrying out this invention, they can be made into a suitable number, a location, a configuration, etc.
[0021] In addition, in each drawing, the same sign is given to the same component.
[0022]
[Effect of the Invention] Since this invention is constituted as mentioned above, the effectiveness hung up over below is done so. The stray light through Si substrate etc. can be shaded by preparing a protection-from-light layer, and the bad influence which it has on a receiving component can be controlled to the minimum.
[0023] Moreover, in case the V groove for waveguide core mounting and the plinth for LD component mounting are prepared by performing etching to a silicon substrate, the stray light by the simultaneous-transmission-and-reception actuation by wavelength multiplexing can be stopped by using a W-Si layer, Cr layer, etc. which are formed as a mask as a protection-from-light layer, without needing the production process of complicated optical waveguide.

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CLAIMS

[Claim(s)]
[Claim 1] It is the optical waveguide which is the optical waveguide which leads the signal light from the light emitting device in an optical access system to a photo detector, is equipped with the semi-conductor substrate as a platform substrate, the cladding layer which has the waveguide core of signal light, and the protection-from-light layer arranged between this cladding layer and said semi-conductor substrate, and is characterized by this protection-from-light layer shading the stray light of said signal light which carries out incidence to said photo detector from said light emitting device through said semi-conductor substrate.
[Claim 2] Optical waveguide according to claim 1 characterized by forming a protection-from-light layer in the top panel of said cladding layer.
[Claim 3] Said protection-from-light layer is optical waveguide according to claim 1 or 2 characterized by being a tungsten-silicon layer.
[Claim 4] Said semi-conductor substrate is optical waveguide according to claim 1 to 3 characterized by being a silicon substrate.
[Claim 5] The protection-from-light layer which is the optical transceiver module used by the optical access system, and is equipped with optical waveguide according to claim 1 to 3, and this optical waveguide has is an optical transceiver module characterized by shading the stray light of the signal light which carries out incidence to a photo detector from a light emitting device through the semi-conductor substrate used as a platform substrate.
[Claim 6] The optical waveguide manufacture approach characterized by leaving the mask used in order to etch into a predetermined configuration the front face of the semi-conductor substrate which is the manufacture approach of the optical waveguide which leads the signal light from the light emitting device in an optical access system to a photo detector, and turns into an abbreviation tabular platform substrate as a protection-from-light layer.
[Claim 7] The optical waveguide manufacture approach according to claim 6 characterized by using tungsten-silicon for said protection-from-light layer.
[Claim 8] The optical waveguide manufacture approach according to claim 6 or 7 characterized by using a silicon substrate for said semi-conductor substrate.

[Translation done.]